

City of Boulder Dental Wastewater Mercury Reduction –Program Overview

In 2003, the city of Boulder was issued a Colorado Discharge Permit System permit with an effluent mercury standard of 12 nanograms per liter (ng/L). The advent of this limit required additional focus on mercury from the pretreatment staff, wastewater staff and laboratory personnel. Despite such efforts, effluent samples collected at the wastewater treatment plant (located at 4049 75th Street) are approaching, and in some cases, have exceeded the limits established for Boulder Creek. Since May 2004, the WWTP has had four excursions with levels as high as 25.9 ng/L (Table 1).

Concurrently with the permit changes, the EPA Region VIII began to develop focused policy guidance for mercury control to wastewater treatment plants (WWTPs). While this policy guidance remains in draft form, the essential need to control mercury discharges to wastewater treatment plants cannot be set aside. On a national level, the EPA has recently lowered the maximum level of allowable mercury. It is probable that as city permits are renewed, additional utilities will be forced to regulate mercury levels.

Among sources of mercury, dental amalgam is an avoidable pollutant. The amalgam or mixture of metals includes copper, tin, silver, zinc and is roughly 50 percent mercury. Disposal of amalgam containing mercury is problematic as it cannot be incinerated and should not be flushed down the drain. Once in the environment, mercury can be converted to its most toxic form, methyl-mercury. Methyl-mercury is persistent and bio-accumulates within the environment. Exposure can cause damage to the development and functioning of the nervous system as well as various environmental concerns.

Another complication is that mercury is not degraded or destroyed by the treatment process; most of the mercury will settle in bio-solids or will be discharged into streams. Furthermore, sewer sludge with a high concentration of mercury is classified as a toxic waste and cannot be sold or land applied. Mercury reduction in wastewater can be attainable through proper handling and the use of filters and separators in dental offices. Therefore, the best way to reduce mercury is by preventing its release from the source.

The Colorado Department of Public Health and Environment (CDPHE) explained that the point is not how much dental offices contribute to the source of mercury in lakes and streams, but that dental offices have the means to dramatically minimize the amount of mercury discharged (Fact Sheet 2004). In addition, it has been stated that the installation of an ISO-approved separator and best management practices (BMPs) including proper disposal of amalgam waste from traps, filters and separators, dental offices can capture up to 99.9 percent of their amalgam waste (PACE; Amalgam Separator Resource Sheet).

What are the options?

As lower mercury limits are set, more jurisdictions have established mercury reduction programs. Nationally, there are numerous voluntary programs and regulatory programs exist in CA, CO, MN, OR, WA, WI and across the New England states. Unfortunately, little success has come out of voluntary programs. A report by King County, WA reported that during a seven-year period (1994-2000), dental offices were encouraged to install separators with cash incentives. The county spent an estimated \$250,000 on the outreach and incentives; however, after seven years, only three percent (24 of 900) of the offices had installed a separator. It was not until the county warned that mercury levels would be enforced that 80 percent of dental offices installed separators.

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The city of Boulder also has a history of working to establish a voluntary program to minimize the environmental impact by dental offices. In 1997, the Dental Waste Pollution Prevention Project was established with funds awarded from the CDPHE. This grant provided funds for dental office monitoring as well as the development and printing of best management outreach materials. The grant also initiated cooperative efforts between the city of Boulder and PACE. PACE developed a voluntary dental certification program and has assisted 13 of approximately 91 dentists within Boulder with the installation of an amalgam separator. Those offices that have installed separators may view it as responsible business protocol and additional offices within Boulder are waiting for the final catalyst to move forward with the installation of a separator.

An arduous alternative to requiring installation would include setting and monitoring wastewater mercury discharges from dental offices. Monitoring discharges from dental offices can be difficult as the levels tend to fluctuate daily if not hourly. It is also logistically difficult to tap into the waste stream without altering the vacuum system and financially expensive as samples are most often sent off-site for analysis.

The American Dental Association (ADA) has suggested BMPs, stating “*Amalgam should not be disposed of in the garbage, infectious waste ‘red bag’ or sharps containers. Amalgam should also not be rinsed down the drain.*” Since 1984, the ADA has recommended the use of pre-capsulated amalgam alloy only. Most mercury reduction programs that require the installation of amalgam separators also require the implementation of BMPs.

Consequently, in order to reduce the mercury discharged and to comply with the state’s limit for clean waterways, the city of Boulder is suggesting a mandatory implementation of BMPs and installation of an amalgam ISO 11143 certified separator in all dental practices handling mercury.

New regulations will be applicable to all dental practices that generate or discharge wastewater from amalgam-related processes. Exclusions may include periodontists, orthodontists or oral surgeons. Waivers will be accepted in writing and granted to any practice in which no dentist removes or places amalgam and/or teeth containing amalgam.

What have other programs done?

Mercury programs are well established on the East and West coasts and are becoming more common in the Midwest and Western states. Within Colorado, Ft. Collins is the first regulatory program with additional voluntary programs across the state. Although Ft. Collins did not have a mercury discharge limit, the concentration of mercury exceeded the manageable head-works load. Effective July 1, 2005, Ft. Collins required basic BMPs as well as the installation of an amalgam separator (with an efficiency of 95 percent) in any office removing two or more amalgams in one year. The response within the dental community was fairly positive with few offices opposing the regulations, some extensions were made for offices that were unable to meet the time restraints. Ft. Collins has measured an approximate 30 percent reduction in mercury in wastewater.

Information about amalgam separators

A. Separator Technology and Efficiency levels - ISO 11143: International Organization for Standardization (ISO)

Using physical and chemical processes such as filtration, sedimentation, centrifugation and ion exchange, amalgam separators can remove particulate mercury matter as small as 100µm in diameter. However, it is important to note that not all separators are equally effective at the same flow rate; efficiencies are determined for a specific flow rate at which that unit can operate. Tested flow rates vary from 1 liter per minute to 4 liters per minute. Dental practices must select a separator that has

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been tested and approved at a flow that is comparable to their maximum flow rate discharged.

Currently, the ISO 11143:1999 standard guarantees efficiencies of at least 95 percent removal. This ISO 11143 standard has served as a benchmark; however, some states have raised the bar by requiring as high as a 99 percent removal. For the most part, utilities requiring higher standards, work under large departments, with the staff required to monitor practices and manufacturers. Current programs are in: VT, CT, Milwaukee, San Francisco, Ft. Collins at 95 percent; MA, ME at 98 percent; MN, NY at 99 percent. It should be noted that the ISO testing protocol is being re-evaluated which may lead to higher testing standards including maximum flow capacity. New protocol is expected to be released in August 2007.

The requirement of efficiency standards to exceed that set by the ISO 11143 reflects the current industry trends and the advancement of best available technology. Furthermore, with mercury coming to the forefront of environmental issues and growing public concern, more pressure has been placed on utilities to achieve the highest standard possible. Although the city of Boulder is proposing the requirement of separators with an efficiency of at least *95 percent*, it should be suggested that each dental practice selects a separator with the highest efficiency level attainable in their working conditions.

B. Testing and Certification:

In order to assure that manufacturers are complying with the ISO standards and their products are satisfactory, a few programs require additional accreditations from certified laboratories and certification bodies. Additional test and certifications are initiated and paid for by the manufactures; this assures the highest quality and releases the governing body of the responsibility of such quality assessments. Certification programs review testing reports, examine design changes as well as conduct market surveillance (inspecting products on market) and conduct periodic visits to the manufacturer in order to ensure that models produced are those that were originally tested. Currently, the two certification bodies that are widely accepted are RWTUV (Germany) and SP Swedish National Testing and Research Institute (Sweden).

Although the city of Boulder will not be requiring additional testing, we are compiling a list of separators that meet the ISO standards and will note those that are *tested and certified*; separators on the list have met the highest quality standard and testing available. It is important to note that the list will not be all-inclusive and should be used as a guide. The city of Boulder does not endorse any manufacturer and will not be responsible for faulty equipment or improper installation. Ultimately, it is the decision of the dental practice which unit will be installed.

C. Cost of Separators:

Table of estimated annual cost for amalgam separators: PACE Resource Sheet 2006

	Small (1-4 chairs)	Medium (5-12 chairs)	Large (+12 chairs)
Purchase	\$200-1200	\$666-2200	\$2500-8800
Installation	\$100-200	\$125-260	\$200-1000
Maintenance	\$0-200	\$0-200	\$0-200
Replacement	\$50-750	\$75-750	\$500-2100
Estimated annual cost	\$185-940	\$257-974	\$1740-4060

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Cost of amalgam separators can vary, but are relative to the size of the dental operation. Prices listed on the previous table are based on information gathered by PACE from manufacturers in September 2005. Maintenance and replacement costs are averaged to annual estimates and replacement costs includes the cost of recycling services and shipping. It is important for each dental practice to review information on manufacturers and vendors of specific separators. In many cases, the vendors will arrange yearly maintenance and waste removal.

Best Management Practices (BMPs):

BMPs are designed to protect and assist dental practices with the management of amalgam as well as minimize exposure. Under the proposed regulations, dental offices will certify that their practice is complying with BMPs within six months of the effective regulations and will then be required to renew the certification annually.

Non-Compliance:

Dental practices who handle amalgam and who do not implement BMPs and/or install an amalgam separator will be subjected to enforcement. Names and offices will be published in the newspaper displayed as “NOTICE OF NONCOMPLIANCE”. Offices not completing compliance forms will likely be inspected by a city of Boulder employee. Additional enforcement options include notices of violation, fines and imprisonment.

- Criteria from DRAFT regulation- Amalgam Separators and Best Management Practices

(a) Requirements. All dental practices that discharge wastewater generated from the placement or removal of amalgam are required to install an amalgam separator in accordance with the following guidelines and to implement the following BMPs.

(1) Dental Practice. Within one year of the effective date of this rule, all dental practices shall have installed and are required to maintain and utilize an approved amalgam separator according to the requirements contained in this rule. Within six months of the effective date of this rule, all dental practices shall be required to implement and certify the BMPs and to recertify them annually according to the requirements contained in this rule.

(2) Exempt Dental Practice. Waivers will be granted to dental practices in which no dentist places or removes amalgams containing mercury and / or teeth containing mercury amalgams. A written request for a waiver must be sent to the City of Boulder’s Industrial Pretreatment Program within six months of the effective date of this rule.

(b) Amalgam separators. Amalgam separators shall be installed in all dental practices, except in the case of exempt dental practices. All amalgam separators shall meet the following criteria:

(1) Amalgam separator design. The amalgam separator shall be ISO 11143 certified and shall be designed and approved for a flow rate capable of handling the maximum volume discharged from the dental practice it serves.

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a. The amalgam separator must be tested according to the most current ISO 11143 standard. Each dental practice should select a separator with the highest efficiency level attainable in their working conditions.

b. If ISO increases the acceptable standard, the dental practice must comply with the new standard within five years.

(2) Installation. The amalgam separator shall be installed so that all amalgam-contaminated wastewater will pass through the unit before being discharged.

(3) Inspection and maintenance. Each dental practice shall be responsible for inspecting and maintaining the amalgam separator.

(4) Disposal. Waste removed from the amalgam separator shall be collected and handled in accordance with the manufacturer's instructions and as described below.

(c) Best Management Practices. BMPs shall be implemented, certified, and recertified each calendar year by February 15th. Each dental practice shall comply with the following BMPs:

(1) Equipment. The dental practice shall ensure that all dental chairs are equipped with chair-side traps and that all vacuum pumps are equipped with traps and filters. All equipment shall be cleaned and maintained in accordance with the manufacturer's instructions.

(2) Clean-up procedures. Each dental practice shall use non-chlorine or non-oxidizing disinfectants and neutral cleaners. When cleaning filters or collecting scrap amalgam, the dental practice shall not rinse filters or traps over sinks or drains. Each dental practice shall maintain a mercury spill kit and train all technical and medical staff on clean-up procedures. Spilled amalgam must be cleaned up immediately in accordance with the proper EPA procedure: <http://www.epa.gov/epaoswer/hazwaste/mercury/faq/spills.htm>

(3) Recycling. The dental practice shall recycle all bulk mercury and all amalgam waste.

(4) Salvaging. All contact and non-contact scrap amalgam should be salvaged and stored in structurally sound, tightly closed and appropriately labeled containers.

(5) Disposal. The dental practice shall never dispose of amalgam waste in the garbage, infectious waste or biohazard containers. All amalgam waste shall be transferred to an offsite recycling facility for recycling of mercury.

(6) Amalgam selection. The dental practice shall use only pre-capsulated, single-use amalgam and shall stock a variety of sizes in order to minimize waste. The dental practice shall also substitute amalgam whenever possible and provide health information about amalgam containing mercury and possible alternatives.

Table 1: Effluent mercury levels collected at the WWTP 3/8/2004-7/24/2006

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SAMPLEDATE	RESULT(ng/L)
3/8/2004	10.8
5/24/2004	16.3
6/29/2004	7.1
7/28/2004	5
9/29/2004	5.8
10/27/2004	5.2
11/17/2004	10.4
12/27/2004	10.1
2/23/2005	9.6
3/30/2005	8.9
4/27/2005	6.8
5/24/2005	25.9
7/12/2005	10.8
8/31/2005	10.1
9/21/2005	8.5
10/18/2005	4.7
11/21/2005	13.4
1/25/2006	11.2
2/21/2006	9.6
3/17/2006	19.7
4/17/2006	4.2
7/24/2006	10.2